Philip Harris

EQUIPMENT NOTES

P67410/8
P67411/9

DIGICOUNTER

DIGICOUNTER

PURPOSE

A versatile digital instrument capable of performing the functions of:-

1. A precision stopclock for all laboratory timing applications.
2. A precision digital frequency meter capable of operation from d.c. to 5MHz typical.
3. A period measuring instrument, enabling accurate measurement of low frequencies.
4. A radioactivity counter and digital ratemeter for use with Geiger Muller tubes and solid state alpha particle detectors.

APPARATUS DETAIL

All the functions of the instrument are controlled by a quartz crystal oscillator operating at a frequency of 100kHz with a typical accuracy of 0.005% ± 1 count at 25°C. The oscillator output is divided down to give gating periods from 100ms to 100s for frequency measurement, 1s to 1000s for radioactivity measurements and standard frequencies from 10kHz to 10Hz for period and timing measurements.

Selection of the desired mode of use is made by setting the FUNCTION SWITCH to one of four positions, whilst the RANGE switch also provides four positions.

In the radioactivity mode the built in E.H.T. supply provides voltages between 300 and 500V for a G.M. tube and an internal preamplifier enables a solid state alpha particle detector to be directly connected to the instrument. Audible indication of counting can be obtained by connecting a loudspeaker to the :□◁ sockets.

The number of digits illuminated can vary from one to six. The unused digits automatically turn on when required.

Output sockets provide 2V or 6V a.c. at 0.5A supplies for use with lamps or light gates.

In the frequency mode three inputs are provided, selected by a three positon slide switch; low frequency d.c. to 5MHz typical, which will operate with TTL inputs, light gates etc., high frequency, capacitively coupled 50Hz to 5MHz typical and high gain, utilising an additional high gain amplifier intended as a microphone or general purpose preamplifier over the audio range.

The period mode has separate input sockets. This input will also accept a light gate for special timing functions. The period input sockets can also be used with the FUNCTION SWITCH at 'radioactivity' or at 'frequency' to obtain an infinite counting period.

Front panel controls and indicators common to all modes of operation or not previously referred to are:-

MAINS: ON/OFF

RESET: resets display to zero

SINGLE/CONTINUOUS READING: selects single readings requiring manual resetting between each reading or continuous automatic re-cycling readings and resetting

STOP/START: initiates manual operation of timing

TRIGGERED OFF/ON: selects manual or triggered timing modes

COUNTING: LED illuminated when any measurement other than 'timing' is in progress

G.M. TUBE SUPPLY: varies G.M. tube voltage

OPERATING PROCEDURE - TIMING

The facilities offered for stopping and starting timing are extensive. They cover most requirements and enable mechanically operated switches, photo-transistor devices and light gates to be used in a variety of modes. It is desirable to familiarize yourself with the operation of the timing section by using switches or light gates on their own without the complication of an experimental set-up.

When timing, read the units marked on the bottom position of the RANGE switch, these will be s or ms. The display will then read in the appropriate units with the decimal point correctly positioned.

Manual control

Set the FUNCTION switch to 'timing' and the STOP/START switch to stop. Set the TRIGGERED timing switch to 'off'. Select the desired position on the RANGE switch.

99999.9)
999999.) marked as ms
9999.99)
99999.9) marked as s

The fully clockwise position of the RANGE switch gives the 0.1s setting.

The fully anti-clockwise position of the RANGE switch gives 0.1ms setting.

Set the MAINS switch to 'on' and press the RESET button to zero this display.

Timing is then controlled by the STOP/START switch and the instrument can be used this way for all experiments where a stopclock or stopwatch would normally be used.

Electrical control

WARNING: Care should be taken when connecting lamps and light gates to the 2V and 6V a.c. output sockets because it is possible to obtain 8V a.c. between one of the 6V sockets and the grounded 2V socket.

Set the FUNCTION switch to 'timing' and the STOP/START switch to 'stop'.

Set the TRIGGERED timing switch to 'off'.

Select the desired position on the RANGE switch.

Switch ON the mains switch and press the RESET button to zero the display.

Timing can now be controlled either by switches, photo-transistors or light gates across the START and STOP sockets. If a colour coded light gate is used, the red socket on the light gate must be connected to the START socket and the black one to the ⏚ . This applies in all cases.

Timing will commence when the START sockets are closed and the STOP sockets open; and always stop when the STOP sockets are closed.

Timing is also possible by using a single switch or light gate (photo-transistor). Two methods are possible -

1 Set the STOP/START switch to 'stop' and connect the switch or light gate between the 'start' socket and ground. Timing will take place when the switch is closed or when the light beam is uninterrupted.

2 Set the STOP/START switch to 'start' and connect the switch or light gate between the 'stop' socket and ground. Timing will take place when the switch is open or when the light beam is interrupted.

Triggered Timing

Set the FUNCTION switch to 'timing' and the TRIGGERED switch to 'on'.

Set the STOP/START switch to 'stop'.

Select the desired position on the RANGE switch.

Switch 'on' the MAINS.

Connect the light gates to the START and STOP sockets observing the polarity stated earlier. Switches may also be used to start and stop in this mode.

Press the RESET button.

Momentarily breaking the START beam will commence the timing and momentarily breaking the STOP beam will stop the timing. Light must fall on the 'start' beam again before the 'stop' beam is interrupted otherwise timing will not stop.

Triggered timing may be accomplished by connecting a single light gate to the PERIOD input sockets (red socket on the light gate to the yellow period input socket, black socket on the light gate to ⏚).

Set the FUNCTION SWITCH to 'period'.

Set the SINGLE READING/CONTINUOUS switch to single reading and press RESET.

Timing will commence when the light beam ceases to be interrupted and stop when the light beam next ceases to be interrupted. Timing will also stop if RESET is pressed. RESET must always be pressed before the light beam is next interrupted to start a subsequent timing.

If the level of ambient light is too high for correct operation of the instrument, connect an additional lead from the yellow, PERIOD input socket to the blue, TIMING input socket.

Examples: If a vehicle has two rods or pieces of card projecting, this method of timing can be used with one light gate to measure the speed of the vehicle by dividing the distance between the rear edges of the projections by the time measured by the Digicounter. The time of swing of a pendulum may be measured accurately with

a single light gate with the pendulum interrupting the beam.

Assume that the pendulum moves from left to right, interrupting the beam and starting the timing. A 4mm plug should be used to short the period input sockets before the pendulum again interrupts the beam when moving from right to left. The short circuit should be removed just before a subsequent left to right movement interrupts the beam to stop the timing. The time for a whole number of oscillations will thus be obtained. Starting on a left to right movement and stopping on a right to left movement will always be inaccurate.

OPERATING PROCEDURE - FREQUENCY MEASUREMENTS

N.B. An input to the PERIOD socket may prevent correct operation in the FREQUENCY mode.

Three input circuits are provided for frequency measurement, each selected by a three position slide switch labelled 'lf', 'hf' and 'high gain'.

'high gain': this input incorporates a separate high gain amplifier intended for general audio frequency measurements over the range of 20Hz-20kHz for signals of amplitude between 0.8mV and 2V r.m.s.

This is the best input to use for general purpose audio work, provided the input voltage is kept below 2V r.m.s. If this input voltage is exceeded, no damage will be done (for inputs up to about 20V r.m.s.) but an inaccurate count will be obtained. For inputs of low amplitude a screened lead should be used, and the input should only be grounded to the mains supply via the ⏚ socket in the FREQUENCY input 'box'. Noise can be picked up by using a different grounded socket on the Digicounter or a grounded socket on some other equipment.

For measuring sound frequencies a high impedance (50k ohm) dynamic microphone is recommended. Crystal microphones will have a poor low frequency response and be more likely to pick up hum.

h.f: this capacitively coupled input is intended for input signals in the range of 20Hz to 3MHz of amplitude 0.2 to 2V r.m.s. The h.f. frequency response extends beyond 3MHz to 5MHz (typical) but at reduced input signal amplitudes in the range of 30 to 50mV r.m.s.

l.f. this input is intended for frequencies below 20Hz and for outputs from TTL or CMOS logic circuits. It may also be used with light gates, phototransistors or cadmium sulphide cells to count interruptions of a light beam.

'high gain' setting:

Set the FUNCTION switch to 'frequency'.

Set the RANGE switch to an appropriate position related to the anticipated input frequency.

Set the frequency slide switch to the 'high gain' position and connect the input signal to the 'high gain' and ⏚ input.

Set the SINGLE READING/CONTINUOUS switch to 'single reading'.

Switch 'on' the mains and press the RESET button.

The COUNTING LED will be illuminated and the display will indicate the frequency of the input signal in Hz or kHz.

If the RANGE switch position was incorrectly chosen for the input frequency, alter the switch position and press the RESET button.

If a continuous sampling of the input frequency is required, set the SINGLE READING/CONTINUOUS switch to 'continuous' and press the RESET button. The instrument will now continuously cycle displaying automatically, resetting between each reading.

'h.f.' setting

The operating procedure for 'h.f.' is the same as that detailed for 'high gain' except that the FREQUENCY slide switch is set to 'h.f.' and the input signal is connected to the 'l.f. - h.f.' and ⏚ input sockets.

l.f. setting

For direct frequency measurement of low frequency signals, the operating procedure is identical to that detailed for 'high gain' and h.f. except that the FREQUENCY slide switch is set to l.f. When measuring the frequency of signals below 20Hz because of the long gate times involved, greater accuracy and convenience is obtained by measuring the period and then calculating the frequency.

To function correctly, the input voltage level has to have an excursion over each cycle so that it goes below +0.8V and above + 2V, e.g. an input of 1.2V peak to

peak would work if its mean d.c. level was +1.4V. A minimum input of +1.4V r.m.s. would be required if its mean d.c. level is 0V. Inputs from TTL gates should always work correctly.

COUNTING OPERATION

The l.f. input can be used to count interruptions of a light beam utilizing phototransistors, light gates or cadmium sulphide cells by utilizing the following procedure.

Set the FUNCTION switch to 'frequency' and the frequency slide switch to 'l.f.'

Set the SINGLE READING/CONTINUOUS slide switch to 'single reading' and the RANGE switch to 1, 10, 100s or 1000s which will give different timings for counting to take place.

Connect the + side of a phototransistor, light gate or cadmium sulphide cell to the yellow 'l.f.' input socket and the - to the ⏚ input socket.

Connect a lead from the yellow 'l.f/h.f.' socket to the blue STOP socket in the TIMING 'box'. The STOP switch is to 'stop' and TRIGGERED 'off'.

Switch the MAINS 'on' and press the RESET button.

The instrument will now count interruptions of the light beam for the time selected.

If it is required to count the interruptions for an indefinite time :-

Set the RANGE switch to '100s' with the FUNCTION switch set to frequency.

Press the RESET button.

After measurement has started wait for a period of 5 to 9 seconds and then with a separate lead, connect a ⏚ socket to the yellow PERIOD input socket.

The instrument will now count until the lead in the PERIOD input socket is removed.

Note: if the connection between a ⏚ and yellow PERIOD socket is made without a 5 to 9 seconds delay the instrument will continue to count for five seconds after the connection is removed.

OPERATING PROCEDURE - PERIOD MEASURMENT

The PERIOD facility enables accurate measurement of the period of very low frequencies to be made, as well as the time between the interruptions of a light beam with a light gate, phototransistor or cadmium sulphide cell.

To function correctly, the input voltage level has to have an excursion over each cycle so that it goes below +0.8V and above +2V e.g. an input of 1.2V peak to peak would work if its mean d.c. level was +1.4V. A minimum input of 1.4V r.m.s. would be required if its mean d.c. level is 0V. Inputs from TTL gates should always work correctly.

Period measurement

Set the FUNCTION switch to 'period' and the RANGE switch to a desired range.

Connect the input to the PERIOD sockets.

Set the SINGLE READING/CONTINUOUS switch to 'single reading'.

Set the MAINS switch to 'on' and press the RESET button.

The instrument will now measure and display the period p of the input signals. Frequency can be calculated from

$$fHz = \frac{1}{p}s$$

If a continuous sampling of the period of the input signal is required, set the SINGLE/CONTINUOUS switch to 'continuous' and press RESET.

WARNING: Inputs must not be left connected to the PERIOD input sockets when the instrument is used in any mode other than PERIOD.

RADIOACTIVITY MEASUREMENTS

With the mains switched off connect the desired radiation detector to the clearly labelled, appropriate input on the front panel of the instrument.

WARNING: do not connect G.M. tubes and alpha particle detectors to the inputs together; connect one or the other.

When using a G.M. tube set the G.M. TUBE SUPPLY control to the recommended supply voltage; normally 420V.

If an audible indication is needed, connect a loudspeaker to the 🔊 sockets. Any loudspeaker will operate, but those with an impedance between 15 and 35Ω will produce maximum output.

Set the FUNCTION switch to 'radioactivity' and the RANGE switch to the required counting time position.

Set the SINGLE READING/CONTINUOUS switch to 'single reading'.

Switch the MAINS 'on' and press the RESET. The instrument will now count for the time that has been set and display the result.

If continuous sampling is required, change the SINGLE READING/CONTINUOUS switch to CONTINUOUS and press the RESET. The final reading will now be displayed for a short time, then the whole process will be repeated.

If it is required to make indefinite time measurements:

Set the RANGE switch to the 10s position.

Press the RESET.

After measurement has started wait for a period of 5 to 9 seconds and then with a separate lead, connect the black ⏚ socket to the yellow PERIOD input socket.

The instrument will now count until the lead in the PERIOD input socket is removed.

Note: If the connection between the black socket and yellow PERIOD socket is made without a 5 to 9 seconds delay the instrument will continue to count for five seconds after the connection is removed.

INTERNAL FREQUENCY or PERIOD CHECK

The yellow 2.5V 0.5A a.c. output socket when connected to the yellow 'high gain' FREQUENCY input socket will measure the frequency of the mains supply. When connected to the yellow PERIOD socket, the mains period will be measured. In both cases FUNCTION, RANGE and 'high gain' switches must be set appropriately. In U.K. mains frequency will read 49.90 to 50.10Hz period 19.9 to 20.1ms under normal conditions.

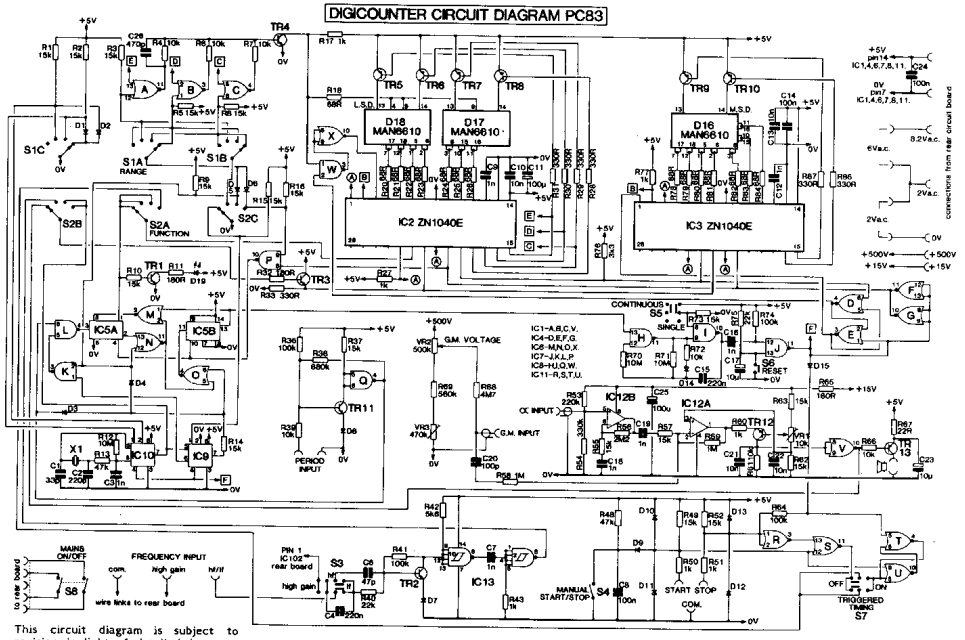
The 2V a.c. output must not be connected to the 'l.f.' or 'h.f.' FREQUENCY inputs otherwise noise spikes are likely to give a high reading.

SPECIFICATION

CRYSTAL OSCILLATOR:	100kHz accuracy typically 0.005% ± 1 count at 25°C
DISPLAY:	6 digit 7 segment bright red/orange LED 14mm high
RADIOACTIVITY:	
Inputs:	G.M. tube via PET connector with supply adjustable from 300-500V d.c.
	solid state alpha detector via miniature b.n.c. connector; built-in amplifier
Counting times:	1, 10, 100 or 1000 seconds and infinity. Single or continuous readings by selection with SINGLE READING/CONTINUOUS slide switch
Counting rate:	Obtained by dividing count by counting time
Output:	Loudspeaker output sockets provided. Loudspeaker impedance of 3-15Ω recommended for maximum output. Output is short circuit proof
TIMING:	
Ranges:	0 to 99.9999s in units of 0.1ms 0 to 999.999s in units of 1ms 0 to 9999.99s in units of 0.01s 0 to 99999.9s in units of 0.1s
Range selection:	By 4 position switch and indicated by position of decimal point on display Display also features most significant digit blanking
Gating:	Manual STOP/START switch
	Mechanical contact closures connected to START/STOP sockets
	Light operated switching to START/STOP sockets
	Triggered timing with light gates selected by TRIGGERED OFF/ON switch (momentary interruption of light beam)
Outputs:	2V 0.5A or 6V 0.5A for light gates or lamps
FREQUENCY:	
Inputs:	l.f. : d.c. to 3MHz (5MHz typical) will operate with TTL or CMOS logic inputs and light operated switches. Impedance 20kΩ
	h.f. : capacitively coupled 20Hz to 3MHz (5MHz typical). Input amplitude 0.2 to 2V r.m.s. to 3MHz reducing to 30 to 50mV r.m.s. up to 5MHz typical. Impedance 20kΩ
	high gain: 20 to 20kHz Input amplitude 0.8mV to 2V r.m.s. (0.3mV min. typical). Impedance 100kΩ

Accuracy:	0.005% ± 1 count typical at 20°C
PERIOD:	
Timing intervals:	0.1, 1, 10 and 100ms:
Input:	TTL compatible; can also be operated by light operated switches. Also provides facility for infinite counting
MAINS INPUT:	110-120V 50/60Hz - P67411/9 220-240V 50/60Hz - P67410/8
DIMENSIONS:	380 x 165 x 140mm width x height x depth.

DIGICOUNTER CIRCUIT DIAGRAM PC83



This circuit diagram is subject to revision in light of detailed improvements.

DIGICOUNTER

Circuit reference				P.H. Ltd., Part No.
C1	33p	100V	Ceramic	200722
C2	220p	100V	Ceramic	201128
C3	1n	100V	Ceramic	201443
C4	220n	250V	Polyester	202562
C6	47p	100V	Ceramic	200802
C7	1n	100V	Ceramic	201443
C8	100n	250V	Polyester	202404
C9	1n	100V	Ceramic	201443
C10	10n	50V	Ceramic	201927
C11	100µ	16V	Electrolytic	203842
C12	1n	100V	Ceramic	201443
C13	10n	50V	Ceramic	201927
C14	100n	250V	Polyester	202404
C15	220n	250V	Polyester	202562
C16	1n	100V	Ceramic	201443
C17	10µ	16V	Electrolytic	203361
C18	1n	100V	Ceramic	201443
C19	1n	100V	Ceramic	201443
C20	100p	500V	Ceramic	200963
C21	10n	50V	Ceramic	201927
C22	10n	50V	Ceramic	201927
C23	10µ	16V	Electrolytic	203361
C24	100n	250V	Polyester	202404
C25	100µ	16V	Electrolytic	203842
C26	470p	160V	Polystyrene	201281
C101	2µ2	450V	Electrolytic	203042
C102	2µ2	450V	Electrolytic	203042
C103	4700µ	10V	Electrolytic	204641
C104	100n	250V	Polyester	202404
C105	100n	250V	Polyester	202404
C106	10µ	16V	Electrolytic	203361
C107	220µ	40V	Electrolytic	204001
C108	220µ	40V	Electrolytic	204001
C109	100µ	16V	Electrolytic	203842
C110	10µ	16V	Electrolytic	203361
C111	10µ	16V	Electrolytic	203361
C112	100n	250V	Polyester	202404
C113	100µ	16V	Electrolytic	203842
C114	10n	50V	Ceramic	201927
R1	15k	0.25W 5%	C.F.	212963
R2	15k	0.25W 5%	C.F.	212963
R3	15k	0.25W 5%	C.F.	212963
R4	10k	0.25W 5%	C.F.	212884
R5	15k	0.25W 5%	C.F.	212963
R6	10k	0.25W 5%	C.F.	212884
R7	10k	0.25W 5%	C.F.	212884
R8	15k	0.25W 5%	C.F.	212963
R9	15k	0.25W 5%	C.F.	212963
R10	15k	0.25W 5%	C.F.	212963

DIGICOUNTER

Circuit reference					P.H. Ltd., Part No.
R11	180R	0.25W	5%	C.F.	212041
R12	10M	0.5W	5%	C.F.	214322
R13	47k	0.25W	5%	C.F.	213201
R14	15k	0.25W	5%	C.F.	212963
R15	15k	0.25W	5%	C.F.	212963
R16	15k	0.25W	5%	C.F.	212963
R17	1k	0.25W	5%	C.F.	212405
R18	68R	0.25W	5%	C.F.	211841
R20	68R	0.25W	5%	C.F.	211841
R21	68R	0.25W	5%	C.F.	211841
R22	68R	0.25W	5%	C.F.	211841
R23	68R	0.25W	5%	C.F.	211841
R24	68R	0.25W	5%	C.F.	211841
R25	68R	0.25W	5%	C.F.	211841
R26	68R	0.25W	5%	C.F.	211841
R27	1k	0.25W	5%	C.F.	212405
R28	330R	0.25W	5%	C.F.	212162
R29	330R	0.25W	5%	C.F.	212162
R30	330R	0.25W	5%	C.F.	212162
R31	330R	0.25W	5%	C.F.	212162
R32	180R	0.25W	5%	C.F.	212041
R33	330R	0.25W	5%	C.F.	212162
R36	100k	0.25W	5%	C.F.	213366
R37	15k	0.25W	5%	C.F.	212963
R38	680k	0.25W	5%	C.F.	213761
R39	10k	0.25W	5%	C.F.	212884
R40	22k	0.25W	5%	C.F.	213042
R41	100k	0.25W	5%	C.F.	213366
R42	5k6	0.25W	5%	C.F.	212761
R43	1k	0.25W	5%	C.F.	212405
R48	47k	0.25W	5%	C.F.	213201
R49	15k	0.25W	5%	C.F.	212963
R50	1k	0.25W	5%	C.F.	212405
R51	1k	0.25W	5%	C.F.	212405
R52	15k	0.25W	5%	C.F.	212963
R53	220k	0.25W	5%	C.F.	213522
R54	330k	0.25W	5%	C.F.	213602
R55	15k	0.25W	5%	C.F.	212963
R56	2M2	0.5W	5%	C.F.	214002
R57	15k	0.5W	5%	C.F.	212963
R58	1M	0.5W	5%	C.F.	213944
R59	1M	0.5W	5%	C.F.	213844
R60	1k	0.5W	5%	C.F.	212405
R61	10k	0.5W	5%	C.F.	212884
R62	15k	0.5W	5%	C.F.	212963
R63	15k	0.5W	5%	C.F.	212963
R64	100k	0.25W	5%	C.F.	213366
R65	180R	0.25W	5%	C.F.	212041
R66	10k	0.25W	5%	C.F.	212884
R67	22R	0.5W	5%	C.F.	211604
R68	4M7	0.5W	5%	C.F.	214161
R69	560k	0.25W	5%	c.F.	213721

DIGICOUNTER

Circuit reference			P.H. Ltd. Part No.
R70	10M	0.5W 5% C.F.	214322
R71	10M	0.5W 5% C.F.	214322
R72	10k	0.25W 5% C.F.	212884
R73	15k	0.25W 5% C.F.	212963
R74	100k	0.25W 5% C.F.	213366
R75	22k	0.25W 5% C.F.	213042
R76	3k3	0.25W 5% C.F.	212641
R77	1k	0.25W 5% C.F.	212405
R78	68R	0.25W 5% C.F.	211841
R79	68R	0.25W 5% C.F.	211841
R80	68R	0.25W 5% C.F.	211841
R81	68R	0.25W 5% C.F.	211841
R82	68R	0.25W 5% C.F.	211841
R83	68R	0.25W 5% C.F.	211841
R84	68R	0.25W 5% C.F.	211841
R86	330R	0.25W 5% c.F.	212162
R87	330R	0.25W 5% C.F.	212162
R101	820R	0.25W 5% c.F.	212361
R102	10M	0.5W 5% C.F.	214322
R103	22k	0.25W 5% C.F.	213042
R104	100k	0.25W 5% C.F.	213366
R105	22k	0.25W 5% C.F.	213042
R106	3k3	0.25W 5% C.F.	212641
R107	100k	0.25W 5% C.F.	213366
R108	10k	0.25W 5% C.F.	212884
R109	330k	0.25W 5% C.F.	213602
R110	820R	0.25W 5% C.F.	212361
		C.F. - Carbon film	
VR1	10k	0.1W Skeleton pre-set	222100
VR2	500k	2W Linear	222961
VR3	470k	0.1W Skeleton pre-set	222960
VR101	470k	0.1W Skeleton pre-set	222960
IC1		MC14001	095007
IC2		ZN1040E	095052
IC3		ZN1040E	095052
IC4		MC14001	095007
IC5		MC14013	095011
IC6		MC14001	095007
IC7		MC14011	095006
IC8		MC14011	095006
IC9		RDD104	095051
IC10		RDD104	095051
IC11		MC14001	095007
IC12		CA3240E	095049
IC13		74LS13	095059
IC101		MC7805	095050
IC102		LM358	095028

DIGICOUNTER

Circuit reference		P.H. Ltd. Part No.
TR1	BC183LC	094010
TR2	BC183LC	094010
TR3	B183LC	094010
TR4	B183LC	094010
TR5	2N4403	094024
TR6	2N4403	094024
TR7	2N4403	094024
TR8	2N4403	094024
TR9	2N4403	094024
TR10	2N4403	094024
TR11	BC183LC	094010
TR12	BC213LC	094018
TR13	BC213LC	094018
D1-D15	1N4148	100006
D16	MAN6610	095053
D17	MAN6610	095053
D18	MAN6610	095053
D19	L.E.D. Red	095045
D101-D106	1N4005	105001
D107	1N4148	100006
Z101	BZY88 15V	102005
X1	100kHz crystal	094035
S1	3 pole 4 way	120011
S2	3 pole 4 way	120011
S3	2 pole 3 way	121002
S4	S.P.C.O.	122018
S5	D.P.C.O.	121005
S6	Single pole, momentary	115003
S7	D.P.C.O.	121005
S8	D.P.C.O.	122017
T1		123470
F1	(For 110V-120V T500mA	043014
	(For 220V-240V T250mA	043010